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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Apparatus for Folding and Interleaving Sheets of Material

I, HEDWIG GAMBLE, a British Subject, of The Lerner Machine Co. Ltd., Lea Valley Road, Ponders End, Middlesex, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for folding and interleaving sheets of material, for example paper. In the packaging of toilet tissues, such as facial handkerchiefs, it is the practice to fold each tissue and interleave it with each adjacent sheet in a pack, so that when one tissue is pulled through an opening in an outer wrap a portion of the next tissue in the pack is presented through the opening so that it is accessible from the exterior of the wrap.

In construction of known apparatus two webs, pretreated to define fold lines, are passed through the nip of co-operating press rollers, the webs being cut into individual sheets as they pass through said nip. The rollers are each provided with rows of pins arranged to engage with the sheets to cause them to fold about their fold lines as they issue from the nip of the rollers. A disadvantage of this construction of apparatus is that the pins form rows of perforations in the sheets adjacent the folded lines thereof, and these perforations tend to weaken and otherwise spoil the sheets. Also, since material can slide off the pins, control is not positive.

An object of the present invention is to provide apparatus for interleaving sheets of material which overcomes this disadvantage.

According to the present invention apparatus for folding and interleaving sheets of material and including a pair of co-operating press rollers through the nip of which the

sheets to be folded and interleaved are passed in face to face, overlapping relationship, is characterised in that each roller is provided with radially extending gripper means adjacent each end adapted to trap the sheets against the cylindrical surface of the roller for a part of its revolution, whereby each sheet is folded transversely with respect to its direction of travel and the ends of the sheets overlapping said each sheet are tucked into the fold thereof.

Preferably each roller is provided with a pair of circumferentially spaced gripper means adjacent each end. Each gripper means may comprise a pivoted finger spring biased into an operative, gripping position, cam means being provided to move and to hold the finger in an inoperative open position. The cam means may be arranged so that the leading fingers, with respect to the direction of rotation of the rollers, are opened before the trailing fingers. Preferably the leading fingers are opened when the rollers have rotated through 60° away from the nip between said rollers.

An embodiment of the invention is illustrated in the accompanying schematic drawings in which:—

Figure 1 shows the entrainment of two webs around creasing, cutting and folding rollers.

Figure 2 shows an end view of a pair of co-operating press rollers, and

Figure 3 is a perspective, end view of part of one press roller.

Referring to the drawing, two webs 1 and 2 of sheet material, for example, paper, are each entrained through the nip between a pair of co-operating creasing rollers 3 and 4. Each web then passes over a guide roller 5 and around a pulley roller 6 and into the nip between a cutting roller 7 and one of a

pair of co-operating press rollers 8, 9. The webs 1 and 2 are then passed into the nip 11 between the press rollers 8 and 9.

Each increasing roller 3 is formed with an axially extending groove 12 in its periphery and each creasing roller 4 is provided with an axially extending blade 13 projecting from its periphery. The rollers 3 and 4 of each pair are coupled together so that once during each cycle of revolution the blade 13 enters the groove 12. Furthermore, the two pairs of rollers 3 and 4 are coupled together so that one pair of rollers is half a phase out of step with the other pair. It will be appreciated, therefore, that when the blade 13 of the roller 4 of each pair enters the groove 12 in the other roller of that pair, the web passing through the nip between said pair of rollers will be pushed into said groove and thereby creased transversely. The fact that the two pairs of rollers 3 and 4 are half a phase out of step means that the creases formed in the webs 1 and 2 are also half a phase out of step. The transverse creases are at intervals equal to the length of the final cut sheet and in such position that a crease is disposed across the transverse centre line of each sheet.

Each cutting roller 7 is provided with a projecting knife blade 15, and each press roller 8 and 9 is provided with a groove 16 to accommodate said cutting blade 15. Immediately behind each groove 16, with respect to the direction of rotation of the rollers 8 and 9, is a row of radially extending pins 17. These pins 17 are retractable so that they can be withdrawn when passing through the nip 11.

The press rollers 8 and 9 are provided at each end with a pair of pivoted gripper fingers 18 and 19, and a recess 20 is formed in each end face of said rollers, diametrically opposed to the fingers 18 and 19. The circumference of the rollers 8 and 9 is substantially equal to the length of the individual sheets being cut, folded and interleaved, and the gripper fingers 18 and 19 are diametrically opposite the grooves 16.

Turning now to Figure 3, an end perspective view of one of the rollers 8 and 9 is shown on an enlarged scale. Each gripper finger 18, 19, is of a general Z shape and is pivotally mounted on the end face of the roller. A head 21, 22 of each finger 18, 19 is hooked over against the surface of the roller. A tension coil spring 23 is attached to each gripper finger 18, 19 and is fast within a bore 24 in the end face of the roller. The gripper fingers 18, 19 are thus spring biased into their closed operative or gripping position.

A cam follower 25 is pivotally mounted at 26 to the end face of the roller and bears against a rail (not shown) of the finger 18. Likewise a cam follower 27 is pivotally

mounted on the end face of the roller and bears against a rail (not shown) of the finger 19. The cam followers 25 and 27 are provided with noses 28, 29 respectively, which are adapted to make contact with a fixed, arcuate cam surface 30. The cam surface 30 is not annular and extends through approximately 280°. A rim 34, 35, respectively, for each nose 28 and 29 on the cam surface 30 is provided, and these are off-set to accommodate the off-setting of the noses 28, 29 and also to cause the leading finger 19 to open before the trailing finger 18 opens.

The sheets of material, for example, paper, issuing through the nip 11 between the press rollers 8 and 9 are folded in a manner to be hereinafter described, and the folded sheets are neatly stacked into a pack in known manner by means of a reciprocating gate 31, (see Figure 2). Furthermore, to assist in the completion of the folding operation of the sheet, fingers 32 are provided, which fingers are known per se.

During operation of the apparatus hereinbefore described, the webs 1 and 2 in their passage over and around the various rollers are creased by rollers 3 and 4 and then cut into individual sheets by rollers 7. When a sheet is cut the leading edge thereof, is already passing through the nip 11 between the press rollers 8, and the new leading edge of the web, formed by the cutting is engaged by the pins 17 immediately behind the grooves 16. Said leading edge is thus fed into the nip 11.

As previously mentioned the creasing and cutting of the two webs 1 and 2 is half a phase out of step, so that the crease in a sheet cut from the web 1, as it passes through the nip 11, is substantially coincident with the trailing edge of one sheet cut and the leading edge of the next successive sheet to be cut from the web 2. The timing of the apparatus is such that the noses 28 and 29 of the cam followers 25 and 27 carried by the roller 8, move out of engagement with the cam surface 30 simultaneously as the crease in a sheet cut from the web 1 passes through nip 11. Likewise, the noses of the cam followers carried by the roller 9 move out of engagement with their cam surfaces simultaneously as the crease cut from the web 2 passes through the nip 11. This means that the gripper fingers 18 and 19 carried by the press roller 8 snap into their closed positions as the crease in a sheet cut from the web 1 passes through the nip 11. This said sheet is thus trapped against the surface of the roller 8, the fingers 18, 19 being disposed one on either side of said crease. The leading fingers 19 also trap the trailing edge of a sheet already cut and partly folded from the web 2, while the trailing fingers 18 trap the leading edge of the next successive sheet to be cut from said

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web 2. As the roller 8 turns, therefore, the sheet cut from the web 1 will be folded about its crease, and the trailing and leading edges of the overlapping sheets cut from the web 2 will be tucked into the fold. This folding operation is performed in the same manner as occurs in the known apparatus which uses rows of pins. After the roller 8 has turned through for example 60° carrying the gripper fingers 18 and 19 away from the nip 11, the leading fingers 19 are released and then the trailing fingers are released. At this stage the fingers 32 are actuated to push the folded sheet away from the roller 8 in known manner. Finally the folded sheet is engaged by the reciprocating gate 31.

The press roller 9 operates in precisely the same manner except that its operation is half a phase out of step with respect to the press roller 8. Thus the individual sheets, successively cut from the webs 1 and 2, are folded transversely with respect to their direction of travel and interleaved with each other.

It will be appreciated that the webs 1 and 2 may be multiple webs or, prior to passing through the nip between the creasing rollers 3 and 4, may be ploughed longitudinally about a longitudinal fold line.

The use of gripper means according to the present invention disposes with the need of rows of pins to grip the sheets and fold them transversely, and although rows of pins are used to feed the leading edges of the cut webs into nip 11, the perforations thereby are of no consequence because they are adjacent the edges of the sheets.

WHAT I CLAIM IS:—

1. Apparatus for folding and interleaving sheets of material, including a pair of co-

operating press rollers through the nip of which the sheets to be folded and interleaved are passed in face to face overlapping relationship, characterised in that each roller is provided with radially extending gripper means adjacent each end adapted to grip the sheets against the cylindrical surface of the roller for a part of its revolution, whereby each sheet is folded transversely with respect to its direction of travel and the ends of the sheets overlapping said each sheet are tucked into the fold thereof.

2. Apparatus according to Claim 1 wherein each roller is provided with a pair of circumferentially spaced gripper means adjacent each end.

3. Apparatus according to Claim 2, wherein each gripper means comprises a pivoted finger spring biased into the operative gripping position, cam means being provided to move and to hold the finger in an inoperative opened position.

4. Apparatus according to Claim 3, wherein the cam means is so arranged that the leading fingers, with respect to the direction of rotation of the rollers, are opened before the trailing fingers.

5. Apparatus according to Claim 4, wherein the leading fingers are opened when the rollers have rotated through 60°, away from the nip between said rollers.

6. Apparatus for folding and interleaving sheets of material, substantially as described hereinbefore with reference to the accompanying drawings.

CARPMAELS & RANSFORD,

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PROVISIONAL SPECIFICATION

Interleaving Machine

I, HEDWIG GAMBLE, British. The Lerner Machine Co. Ltd., Lea Valley Road, Ponders End, Middlesex, do hereby declare this invention to be described in the following statement:—

The method of interleaving sheets of paper cut from 2 webs using rollers bearing lines of pins to transport and interleave the paper is well known. The disadvantage of this system is that when unfolded, the sheet of paper has pin holes right across the centre either side of the fold.

The object of this invention is to overcome the problem of pin holes in the paper by the use of grippers in place of the double row of pins. Gripper mechanisms contained within the roller are also known but they require a large diameter roller to contain them. Such mechanisms are uneconomical and often costly. This invention enables grippers to be used on small rollers.

By ploughing the paper double before in-

terleaving it is possible to produce interfolded sheets of paper of a large size without increasing the dimensions of the working components of the machine.

Two stock reels of paper are mounted on the frames of the ploughing section of the machine and the paper is drawn off by rollers and then ploughed double by any known method.

The two webs of paper then enter the interleaving section of the machine and each double thickness of paper passes between separate sets of transport rollers. These rollers actually pull the webs over the plough, suitable tensioning being provided by jockey rollers, and each pair usually consists of one steel faced roller and one faced with cork, rubber, or similar material.

The webs then pass between creasing rollers which make in them transverse creases at intervals equal to the length of the final cut sheet and in such a position that the

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crease falls in the centre of the cut sheet.

Each web then passes round a cock faced roller and thence between two more rollers, one bearing a knife or perforating blades and the other bearing an anvil for the knife, and pins and grippers which are instrumental in the interleaving operation.

As the paper web passes between these two rollers it is cut or perforated according to the type of paper (one cut taking place per revolution of the rollers).

The "pin and gripper" rollers are adjacent to one another and each have a line of pins mounted on a bar which slides radially on the shaft. These movable pins are situated just behind the position where the cut is effected so that they transport the leading edge of the cut sheet of paper round with the roller until it is at a position coincident with the point of tangency of the two "pin and gripper" rollers. The pin bar then retracts and the paper is taken over by the grippers on the other roller.

The grippers on each roller are positioned on either side of the crease line in the paper and at each end of the roller.

Both grippers close on to the paper when the pin bar in the other roller retracts i.e. at the point when the crease line on one line of paper and a leading edge and a trailing edge of the other line of paper are coincident with the point of tangency of the two rollers.

The grippers remain closed for approximately 60° of the roller's rotation then the

leading gripper opens, thus releasing the paper forward of the crease line and the trailing edge of the other sheet. Shortly afterwards the other gripper opens releasing the paper aft of the crease line and the leading edge of the next sheet.

At this moment the interleaved sheets are removed from the rollers by fingers and delivered from the machine in a vertical position on a moving conveyor band.

The grippers are mounted on the sides of the rollers and are mounted on the sides of the rollers and are pivoted about a point between the surface of the roller and its axis. They are of Z section, the upper arm protruding over the end of the roller to clamp the paper to the surface of the roller and the lower arm being the lever which the cam follower deflects.

The action of the grippers can be obtained by any type of cam mechanism, in this case by rocker arms which follow fixed cam rings which are concentric with the roller.

The rocker arms rotate with the roller and follow the inside contour of the cam ring, the grippers being spring loaded onto the surface of the roller.

The result could also be achieved by having the rocker arms follow the outside of a cam and being spring loaded on to it.

Naturally, this system of interleaving is not confined to webs which have been folded double.

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COMPLETE SPECIFICATION

3 SHEETS

This drawing is a reproduction of
the Original on a reduced scale

Sheet 1

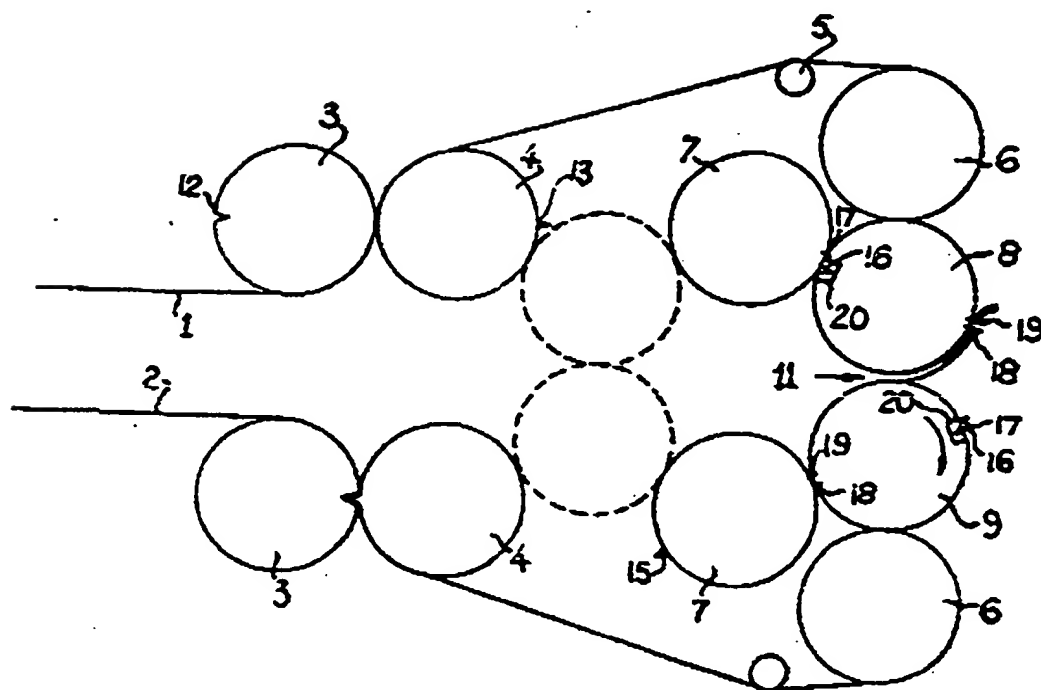
Fig. 1

Fig. 2